

ROLE OF PAIN-RELATED FEAR IN LEARNING ABOUT PAIN

Learning About Pain through Observation: The Role of Pain Related Fear

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### Abstract

Observational learning may contribute to development and maintenance of pain-related beliefs and behaviors. The current study examined whether observation of video primes could impact appraisals of potential back stressing activities, and whether this relationship was moderated by individual differences in pain-related fear. Participants viewed a video prime in which back-stressing activity was associated with pain and injury. Both before and after viewing the prime, participants provided pain and harm ratings of standardized movements drawn from the Photograph of Daily Activities Scale (PHODA). Results indicated that observational learning occurred for participants with high levels of pain-related fear but not for low fear participants. Specifically, following prime exposure, high fear participants showed elevated pain appraisals of activity images whereas low fear participants did not. High fear participants appraised the PHODA-M images as significantly more harmful regardless of prime exposure. The findings highlight individual moderators of observational learning in the context of pain.

**Keywords:** pain-related fear; learning; PHODA; observation; pain appraisal

## 1. Introduction

Pain-related fear has emerged as an important psychological construct in accounting for development of persistent pain and disability following injury (Leeuw et al., 2007; Vlaeyen & Linton, 2000) and avoidant attitudes toward pain (Poiraudreau et al., 2006). While fearful pain-related beliefs are found in the healthy population (Houben et al., 2005), research regarding the origins and maintenance of such beliefs, including mechanisms by which these translate into detrimental pain outcomes, is limited. A recent review by Goubert and colleagues (2011) proposed that observational learning may provide an explanation for the development and maintenance of pain-related beliefs and behaviors.

Observational (or social) learning processes comprise the basis of early accounts of behavior change (Bandura, 1986), including acquisition and maintenance of fear responses (Askew & Field, 2008). Observation of others' behavior in specific contexts or salient stimulus pairings can provide information regarding the consequences of particular actions or the threat value of particular stimuli, subsequently affecting an observer's own behavior. In terms of pain, observational learning provides a valuable tool in that one can identify (or avoid) circumstances, actions, or stimuli observed to result in hurt/harm to others. Observational learning in pain is supported by evidence of social modeling of pain responses (reviewed by Hermann, 2007). Neuroimaging research likewise provides compelling support for the impact of observing others in pain (Lamm et al., 2011), suggesting that similar neural processes may underlie direct and vicarious fear learning (Olsson et al., 2007). Given the relevance of pain-related fear to pain responses in the intrapersonal context --- e.g., attention to personal pain, pain appraisal, physical performance, disability (Leeuw et al., 2007; Van Damme et al., 2010) --- surprisingly few studies have examined the impact of pain-related fear on observational learning responses (Helsen et al., 2011), including learning about the potential pain and harm value of physical activity.

According to the fear-avoidance model (Vlaeyen & Linton, 2000) elevated pain and harm appraisals of physical activity can promote avoidance tendencies that result in a self-perpetuating cycle of disability. Such elevated pain and harm appraisals are found both among high fear chronic pain sufferers and among currently healthy individuals (Goubert et al., 2005; Trost et al., 2009). In light of the detrimental effects of pain-related fear on physical and social functioning (Leeuw et al., 2007), insight into the development and persistence of fearful activity appraisals is particularly important.

Accordingly, the aims of the current study were two-fold. First, we examined whether observation of pain-relevant stimuli could impact pain and harm appraisals of standardized depictions of bending, kneeling, and reaching movements. Second, we examined whether pain-related fear functioned as a moderator of these potentially altered appraisals. To facilitate observational learning, healthy participants viewed a three-minute video prime in which back-stressing activity (specifically, weightlifting) was associated with pain and injury. Both prior to and following prime exposure, participants were asked to provide appraisals of a series of movement images in terms of their potential pain and harm value in the context of back pain. We predicted that viewing the pain primes would lead to elevation in pain and harm appraisals and that this observational learning response would be enhanced among individuals with high pain-related fear. Moreover, because the capacity to appreciate another's perspective is hypothesized as fundamental to observational learning (Goubert et al., 2011), we also examined the role of dispositional empathy (i.e., perspective-taking).

## **2. Methods**

### ***Participants***

The recruited sample included 34 healthy student participants (17 men, 17 women). Participants ranged in age from 18 to 22 years ( $M = 18.9$  years,  $SD = 0.88$  years). Individuals with a history of chronic back pain (defined as pain lasting longer than 3 months), spinal

surgery, or chronic health conditions that could cause pain or restrict movement were excluded from participation. Participants were recruited from the Ohio University Psychology Department research participant pool and received course credit for their participation. All procedures were approved by the Ohio University Institutional Ethical Review Board.

### ***Apparatus and stimuli***

*Video Prime.* The video prime was comprised of nine video segments (10-36 seconds each) showing individuals exhibiting strain and discomfort during performance of weight-lifting exercise, with evidence of injury and subsequent back-specific pain behavior (i.e., wincing, holding the back). Male and female individuals were equally represented in the video primes. All videos were obtained from public online resources and were specifically intended to communicate authentic capture of events rather than staged effect. The video prime stimuli are available from the first author upon request.

*The Photograph Series of Daily Activities Scale – Modified Version (PHODA-M).* For appraisal of physical activity, 30 images were selected from the original PHODA instrument, which comprises 100 photographs depicting common activities ranging from household chores to physical exercise and represents various biomechanical strategies and activity settings (i.e., activities of daily living, housekeeping, work, and sport/leisure) (Kugler et al., 1999). Twenty of these photographs were selected as they could be organized into 10 pairs, where each pair depicted a similar movement strategy and physical burden. Selection of matched image pairs was performed in consultation with the Physical Therapy and Exercise Physiology Department. As an example, a matched pair of images would each depict lifting a small weight from a seated position. An additional 10 images were selected as they were previously used in studies that used an abbreviated version of the PHODA instrument (see (Leeuw et al., 2007; Trost et al.,

2009)<sup>1</sup>. Figure 1 depicts the PHODA - administration protocol. At each time of administration (Time 1 and Time 2), participants rated a total of 20 images, comprising 10 images belonging to a matched pair and 10 images that were repeated. Administration of matched images (i.e., whether one image of a matched image pair was rated at Time 1 or Time 2) was counterbalanced across participants to control for order effects. Materials are available from first author upon request.

To approximate original PHODA administration, participants were shown two vertical rating scales depicting degrees of expected pain and harm to the back, respectively. Each scale ranged from 0 to 100 and was anchored with the terms “Not at all painful”/“Worst possible pain” for the pain scale and “Not at all concerned”/“Extremely concerned” for the harm scale. Mean scores at each administration could thus range from 0 to 100. Procedures for administering the PHODA are described below.

### ***Self-report measures***

*Participants’ frequency of strength training.* To control for familiarity with weight-lifting activities depicted in the video prime, participants were asked to indicate how many days per week they engaged in strength training exercise specifically involving weight lifting and/or resistance training.

*The Tampa Scale for Kinesiophobia* (Kori et al., 1990) was used to assess participants’ level of pain-related fear. Respondents rated 17 items on a four-point scale ranging from 1 (strongly disagree) to 4 (strongly agree). Items include such statements as “I wouldn’t have this much pain if there wasn’t something potentially dangerous going on in my body” and “I can’t do all the things normal people do because it’s too easy for me to get injured”. Responses are summed to create a total score ranging between 17 and 68. The scale’s validity has been supported by evidence that Tampa Scale for Kinesiophobia scores are moderately correlated

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<sup>1</sup> Identical images were initially included to provide a more stringent test of repeated-measures analysis. However, analyses controlling for matched versus identical image sets revealed no significant differences; findings are therefore presented for the complete set of images at Time 1 and Time 2 of administration.

with other measures of pain-related fear (Crombez et al., 1999) and are better predictors of disability in patients with chronic low back pain than general negative affect or negative pain beliefs such as catastrophizing (Crombez et al., 1999). Recent studies have reinforced the Tampa Scale for Kinesiophobia's psychometric properties across various pain conditions, nationalities, and translations (French et al., 2007; Goubert et al., 2004; Roelofs et al., 2004; Roelofs et al., 2007; E. J. Swinkels-Meewisse, et al., 2003). In line with previous investigations (Trost et al., 2012; Trost, et al., 2011), instructions for the Tampa Scale for Kinesiophobia were adapted to reflect participants' current pain-free status. Specifically, the following instructions were used: *"We are interested in the types of thoughts and feelings that you might have in response to muscle pain or joint pain. Please read each of the following statements and circle the number that best represents your thoughts and feelings while experiencing muscle or joint pain."* Cronbach's  $\alpha$  for the current scale administration was .80. Previous studies using this modification demonstrated that initially healthy participants with higher Tampa Scale for Kinesiophobia scores reported elevated pain and harm appraisals as well as decreased physical performance following experimentally-induced back pain; additionally, Tampa Scale for Kinesiophobia scores were found to be positively correlated with other measures of pain-related fear (Trost et al., 2011; Trost et al., 2012).

*The Interpersonal Reactivity Index – Perspective Taking Subscale* (Davis, 1983) was used to gauge dispositional empathic tendency; the perspective taking subscale consists of seven items from the 28-item Interpersonal Reactivity Index and assesses an individuals' tendency/capacity to take the psychological perspective of others (e.g., "When I'm upset at someone, I usually try to "put myself in his shoes for a while."). For the current design, a measure of empathic tendency was included as participants had to appreciate the experience of individuals depicted in the video prime (e.g., as unpleasant or painful) and to reflect on the experience of back pain. The Interpersonal Reactivity Index has demonstrated excellent

psychometric properties (Davis, 1983) across various populations (Hojat et al., 2007) and in prior studies involving observation of pain it has been associated with ratings of others' pain (Green et al., 2009) and with psychophysiological indices of empathic response (Yanget al., 2009).

### **Procedure**

Upon arrival to the laboratory, each participant completed informed consent procedures, the Tampa Scale for Kinesiophobia, the Interpersonal Reactivity Index-Perspective Taking subscale, and provided an estimate of strength training frequency. The experimenter conducting the subsequent testing had no knowledge of the participants' scores at the time of testing. Participants were informed that they would be asked to provide input at several points during the study but were not told in advance about multiple administrations of the PHODA-M.

*PHODA-M Administration Time 1.* Following completion of questionnaires, participants completed the PHODA-M, administered by the experimenter in line with procedures previously used in our lab (Trost et al., 2009). The experimenter laid out the photographs in a random order on a flat surface in front of the participant and provided the following instructions: *"These photographs represent common everyday activities. Please arrange the photographs in order from the activity that you would most avoid to the activity that you would least avoid if you were experiencing back pain. Let me know when you are finished and I will ask you some questions about each activity"*. To ensure comprehension, the participant was asked to repeat these instructions back to the experimenter. The participant was then left alone in the room. When signaled to return, the experimenter showed the participant the pain and harm rating scales and provided the following directions: *"I am going to ask you two questions regarding each photograph. Please indicate, on a scale of 0–100, how much pain you would expect when performing each activity if you were experiencing back pain. Zero indicates no pain, and 100 indicates worst possible pain. You can choose any number on the scale between 0 and 100. I*



*will also ask how concerned you would be about injuring your back when performing each activity. Again, 0 indicates no concern and 100 indicates extreme concern".* After completing the Time 1 PHODA-M appraisals, participants were led to another room where they watched the video prime on a large monitor. Participants were left alone in the room when watching the prime.

*PHODA-M Administration Time 2.* After viewing the video prime, participants repeated the PHODA-M. The second administration of the PHODA-M comprised 10 photographs identical to PHODA-Time 1 administration and 10 images matched to those in previous administration (see Figure 1). Participants were provided with the above instructions and again provided pain and harm ratings of the 20 PHODA-M images.

#### *Data Analysis*

Of interest to the current study was the impact of video prime exposure and individual difference variables (particularly the moderating role of pain-related fear and dispositional empathy) to participants' pain and harm appraisals of PHODA-M images at Time 1 and Time 2. First, correlational analyses were conducted to determine the bivariate relationships among the included variables (i.e., pain-related fear, dispositional empathy, frequency of strength training, and PHODA-M pain and harm ratings obtained at Time 1 and Time 2). Subsequently, repeated measures analyses were conducted for participants' pain and harm ratings of PHODA-M images. For each dependent variable (pain and harm ratings, respectively) participants' Tampa Scale for Kinesiophobia score, Interpersonal Reactivity Index-Perspective Taking score, as well as weight training frequency were entered as covariates into a 2 Time (PHODA-M ratings Time 1, PHODA-M ratings Time 2) repeated-measures model. All covariates were maintained as continuous variables, following the moderation procedures outlined by Holmbeck et al. (2002). The presence of significant higher order interactions involving covariate measures (e.g., pain-related fear) indicated the presence of significant moderation. In case of such higher order

interaction, subsequent analyses were conducted to elaborate the moderator conditions under which the main effect was significant. To this end, two new conditional continuous moderator values were created, representing high (+1 SD above the mean) and low (-1 SD below the mean) scores of the centered moderator variable. Additional ANCOVAs were then performed to examine the significance of the effect for the high and low values of the centered continuous moderator variable, respectively. Importantly, this procedure allows moderator variables to maintain their continuous form, thus maintaining the entire sample in the analysis (please see Holmbeck et al. (2002) for detailed description of statistical procedure).

### **3. Results**

#### ***Participant Characteristics***

Table 1 provides a summary of participant sample characteristics and outcome variables, presented separately for men and women. No significant gender differences were observed for any of the variables of interest. Participants ranged in age from 18 to 22, with a mean of 18.9 years. The mean Tampa Scale for Kinesiophobia score was 31.85 (SD = 6.33), ranging between scores of 21 and 45. The mean Interpersonal Reactivity Index-Perspective Taking score was 15.85 (SD = 3.72), ranging between 8 and 23. Finally, participants engaged in weight training an average of 1.7 (SD = 1.7) times per week, ranging between 0 and 6 times per week.

#### ***Correlational Analysis***

Table 2 shows the pattern of Pearson correlations among participants' pain-related fear (Tampa Scale for Kinesiophobia) scores, dispositional empathy (Interpersonal Reactivity Index-Perspective Taking) scores, frequency of strength training, and PHODA-M pain and harm ratings at Time 1 and 2. Pain-related fear was significantly associated with PHODA-M pain appraisals at Time 2 (following video prime exposure) and with harm ratings both prior to and following prime exposure. PHODA-M pain and harm appraisals were strongly positively

correlated, and pain and harm appraisals obtained at Time 1 were strongly associated with those obtained at Time 2. Frequency of weight training and dispositional empathy score were not correlated with any of the other variables.

### ***Pain Ratings***

Analysis of participants' pain ratings of PHODA-M images showed a significant interaction between Time and pain-related fear,  $F(1, 32) = 6.97, p = .01$ . There were no other significant main effects or interactions involving the Interpersonal Reactivity Index-Perspective Taking score or weight-training frequency. To interpret the significant interaction, two repeated measures ANOVAs were performed, with Time (PHODA-M ratings Time 1, PHODA-M ratings Time 2) as the within-participant variable and either high (+1 SD above the Tampa Scale for Kinesiophobia mean) or low values (-1 SD below the Tampa Scale for Kinesiophobia mean) of pain-related fear entered as covariate. As apparent in Figure 2, these follow-up analyses revealed a significant effect of Time for high Tampa Scale for Kinesiophobia scores,  $F(1, 32) = 23.68, p < .01$ , but not for low Tampa Scale for Kinesiophobia scores,  $F(1, 32) = 1.22, p = .30$ , indicating that high fear participants showed a significant increase in pain ratings from the first to second PHODA-M administration, whereas low fear participants did not. Additional tests of simple slopes were conducted to examine the effect of pain-related fear at Time 1 and Time 2 of PHODA-M administration, respectively. No effect of pain-related fear was identified for PHODA-M pain ratings collected at Time 1, prior to prime exposure,  $F(1, 32) = .61, p = .44$ . Analyses identified a significant main effect of pain-related fear on PHODA-M pain ratings collected at Time 2,  $F(1, 32) = 6.23, p = .02$ , indicating that higher pain-related fear was positively associated with higher PHODA-M pain ratings after participants viewed the video prime (see Figure 2).

### ***Harm Ratings***

Analysis of participants' harm ratings of PHODA-M images revealed a main effect of pain-related fear,  $F(1, 29) = 8.85$ ,  $p = .01$ , indicating that on average participants with higher scores on the Tampa Scale for Kinesiophobia rated PHODA-M images as potentially more harmful. No other main effects or interactions were observed.

#### 4. Discussion

The current study examined whether observing a video prime of individuals suffering back injury as a result of physical exertion could impact subsequent appraisals of potential back stressing activities, and whether this relationship was moderated by participants' level of pain-related fear. In line with our predictions, observational learning responses differed for individuals reporting high versus low levels of pain-related fear. In response to a video prime linking physical activity (i.e., weight lifting) with pain and injury, participants with high pain-related fear showed elevated pain appraisals of physical activity. In contrast, participants with low pain-related fear showed comparable pain appraisal prior to and following video exposure, indicating that the prime had a selective impact on high fear participants. Importantly, pain appraisal differences between high and low fear participants were not apparent at baseline (prior to prime exposure), but only emerged after participants viewed the video prime. Finally, participants with greater pain-related fear rated images of everyday activity as more potentially harmful to the back regardless of prime exposure. The current findings provide preliminary insight regarding individual moderators of observational learning in the context of pain. Additionally, the findings highlight the potential role of observational learning processes in the development and maintenance of fear-avoidant beliefs and possibly behaviors.

The fear-avoidance model offers a valuable framework for understanding how pain-related beliefs and behaviors can pave the road from acute injury to chronic disability (Leeuw et al., 2007). While conceptual associations are central to the fear-avoidance hypothesis (e.g., cognitions linking pain with serious damage and physical activity with imminent harm), virtually

no research has addressed how observational learning (as a form of association-making) may contribute to the formation and perseverance of fearful cognitions and behaviors. The impact of observational learning is supported by investigations of pain interactions among parents and children (Craig, 1986; Hermann, 2007). Likewise, evidence that viewing another's pain engages the observers' own neural structures (Olsson et al., 2007; Olsson & Phelps, 2007) underscores the importance of examining the cognitive, affective, and behavioral responses to pain observation (Goubert et al., 2011). However, despite the intuitive value of observational learning in pain processes, to our knowledge the current study is among the first (e.g., Helsen et al., 2011) to experimentally examine the modulation of observational learning by observer characteristics, with specific attention to observers' pain-related fear.

Because learning can be defined as changes to behavior that occur as a result of exposure to, contact with, or experience with environmental regularities/contingencies (e.g., associations between environmental stimuli, such as physical exertion and pain (De Houwer, 2009; Goubert et al., 2011), high fear participants' elevated pain appraisals of PHODA-M images after viewing the video prime suggests that learning did occur. As apparent in Figure 2, no change in pain appraisals was apparent for low fear participants. With respect to learning about pain, the findings highlight the interaction of observer and stimulus characteristics such that individuals with high pain-related fear selectively responded to stimuli linking pain with injury whereas there was no behavioral impact (and perhaps no informational value) for low fear participants. In turn, this indicates that observational learning processes may play a prominent role in the maintenance or exacerbation of pain-related beliefs and potentially corresponding behaviors, thereby facilitating the pathway to disability. In this way, existing pain-related fear can be viewed a vulnerability factor for acquiring (i.e., learning) fear-relevant information.

Cognitive schema theory and research on attentional processes in the context of pain offer a useful conceptual framework and point to potential mechanisms by which pain-related

fear may impact observational learning. The basic attentional demand of pain has been well-documented in both clinical and nonclinical populations (Eccleston & Crombez, 1999).

Importantly, the attentional prioritization of pain and its disruptive function is enhanced among individuals expressing greater fear of pain or catastrophic pain cognitions (Keogh et al., 2001); high fear individuals likewise show difficulty disengaging from pain cues (Van Damme et al., 2004; Van Damme et al., 2004) and performing distraction tasks (Goubert et al., 2004; Van Damme et al., 2008). Analogously, high fear participants in the current study may have preferentially directed attention toward (or, possibly had difficulty discounting or disengaging from) threatening pain-salient information.

Attentional processes may be guided by existing pain schemas, which comprise pain-related beliefs. Preferential processing of schema-congruent information (e.g., activity being related to pain and harm) may further reinforce existing pain schema and maladaptive pain-related cognitions. As pain-related fear is associated with behavioral avoidance of possibly painful physical exertion, opportunities to receive corrective feedback regarding maladaptive beliefs are limited, further strengthening the schematic structure. Similar schema - confirming processes are demonstrated by high fear pain sufferers' difficulty generalizing information about the safety (or, pain-free consequences) of physical activity across various physical tasks (Crombez et al., 2002; Goubert et al., 2005; Goubert et al., 2002). Conversely, high fear pain sufferers demonstrate relative ease in generalizing information about potential pain and harm (Goubert et al., 2005). In the context of established fear-avoidant beliefs, these learning and attentional processes may undermine the normally useful function served by observational learning (Hermann, 2007). Such "biased" learning may come to reinforce maladaptive schemas by limiting exposure to schema-challenging information, thus possibly contributing to development of disability following experience of real injury.

Although our data support an association between observational learning and elevated

pain appraisals among high fear participants, it is not clear whether these changes would translate to participants' real-world cognitions and behaviors. However, in a previous study with chronic pain patients, we found that high fear participants' pain/harm responses to PHODA-M images were significantly associated with pain/harm expectancy ratings collected immediately prior to actual movement performance and correlated significantly with reported daily disability (Trost et al., 2009). No such association was observed for low fear participants, suggesting that the PHODA-M assessment may have specific ecological validity for those with high fear. Although the question remains to be empirically examined, our previous findings suggest that the PHODA-M responses of healthy high fear participants likewise provide a valid reflection of their real-world appraisals in the face of injury.

In the current study, higher pain-related fear was associated with greater appraisals of harm both before and after prime exposure. This observation is consistent with greater pain expectancies among high fear chronic back pain sufferers (Crombez et al., 2002; Trost et al., 2009). High fear participants with a history of back pain but no current symptoms likewise endorsed greater pain in anticipation of a standardized set of reaching movements (Trost, unpublished data). Unlike our current participants, these latter samples had a clear reference of current/prior pain experience against which to appraise potential movement. In contrast, our screening criteria excluded participants with a pain history. While this may be a limitation to ecological validity, our findings speak to the role of pain-related fear in shaping cognitive responses to current, past, and even projected pain experience.

Surprisingly, the Interpersonal Reactivity Index dispositional empathy measure (gauging ability to adopt another's perspective) was not significantly associated with participants' appraisals of pain and harm. As noted earlier, the capacity to appreciate the perspective of another is hypothesized to be fundamental to observational learning (Goubert et al., 2011). The lack of association between the measure of empathy and our outcome measures may be

indicative of the limitations of the Interpersonal Reactivity Index subscale that we chose to represent the empathy construct or the lack of pain-specificity in the Interpersonal Reactivity Index measure. It is possible that the Interpersonal Reactivity Index is too general a measure to gauge empathic responses specifically relevant to pain experience and a more pain-relevant measure should be employed in future research.

Although harm and pain ratings were highly correlated, the absence of significant effects of time for harm appraisals is not necessarily surprising. In previous research of pain and harm appraisals, high fear chronic low back pain patients faced with a movement challenge tended to overpredict potential harm rather than pain to the back (Trost et al., 2008). In the context of the fear-avoidance model, the distinction between pain and harm is particularly relevant, as high fear individuals may be prone to interpret pain sensation as a sign of serious tissue damage (Leeuw et al., 2007). By contrast, it is less likely that healthy participants without a previous history of back pain would explicitly endorse serious harm to the back following video priming. Implicit measures of pain-harm or movement-harm association may be of particular interest in future research aimed to examine this learning effect (Leeuw et al., 2007). Likewise, implicit measures may be employed to overcome some of the demand characteristics inherent in observation learning methodologies.

*Limitations and Future Directions.* A number of limitations characterize the current investigation and can inform future study designs. First, the current study used a repeated-measures design and did not employ a control group; future studies are encouraged to include a control condition (e.g., no-injury video or no-video) to examine the robustness of the demonstrated effect and potential differences in learning. As noted above, our outcome measures of pain and harm appraisals would ideally be complemented by behavioral information. As with implicit measures, behavioral testing may provide further protection against possible demand characteristics. Additionally, we looked at a summary measure of appraisal



for the PHODA-M measure; however, it would be interesting to examine whether individuals selectively generalize observed information across various types of activities and whether participant characteristics moderate conservative versus liberal generalization strategies. In this sense, familiarity with the observed activity is of specific import; weight training represents a commonly observed activity. It would be interesting whether the findings extend to potentially painful activities with which participants were more/less familiar. In the same vein, potential identification (i.e., perceived similarity) of the participant with the observed model is also of great interest and may moderate the effect observation and/or the influence of self-reported empathy. It would likewise be valuable to examine the impact of observing information that challenges existing pain-related schema, such as observing others participate in potentially painful behavior that does not result in negative repercussions. In short, there are numerous untapped directions for exploring the effect of observation on learning and behavior in the pain context. Such research would likely provide useful input for therapeutic interventions in the clinical setting.

## **Disclosures**

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## Figure Legends

*Figure 1.* Participants first appraised images *A* and *B*, then watched the video prime, and finally appraised images *C* and *D*. Images *A* and *C* were identical; comprising photographs 19, 25, 49, 63, 69, 76, 77, 80, 93, and 98 from the original PHODA measure (Trost et al., 2009). Images *B* and *D* were matched, depicting the same activity but not otherwise identical. Images *B* comprised photographs 7, 8, 10, 13, 22, 28, 31, 33, 54, 91 from the original PHODA measure and *D* images comprised photographs 27, 90, 55, 3, 26, 47, 96, 29, 71, 57. Order of administration for *B* and *D* was counterbalanced across participants.

*Figure 2.* Mean PHODA-M pain ratings at Time 1 (prior to viewing video prime) and Time 2 (after viewing video prime) for participants with low (-1 SD below the mean) and high (+1 SD above the mean) levels of pain-related fear (Tampa Scale for Kinesiophobia). \*  $p < .05$

## Tables

Table 1. Characteristics of the participant sample.

Variable (Units)	Range	Cronbach's $\alpha$	Male (n = 17)		Female (n = 17)	
			Mean	(SD)	Mean	(SD)
Age (years)	18– 22	-	18.9	(0.9)	19.0	(0.9)
Strength Training Freq. (days/week)	0– 6	-	1.7	(1.9)	1.7	(1.6)
TSK	21– 45	0.80	31.8	(6.7)	31.9	(6.9)
IRI - PT	8-23	0.68	15.2	(3.8)	16.5	(3.7)
PHODA-M Pain - Time 1	13.4– 89.9	0.93	41.0	(17.2)	45.0	(18.7)
PHODA-M Pain - Time 2	14.3– 88.8	0.92	46.0	(18.6)	54.0	(14.7)
PHODA-M Harm - Time 1	4.8 – 82.0	0.93	33.1	(18.5)	44.7	(15.8)
PHODA-M Harm - Time 2	10.9 – 88.7	0.93	40.8	(18.9)	51.3	(15.9)

*(TSK = Tampa Scale of Kinesiophobia; PHODA-M -Photograph of Daily Activities Scale – Modified Version; IRI- Interpersonal Reactivity Index, Perspective Taking Subscale)*

Table 2. Association between TSK and PHODA-M ratings

Measures	1	2	3	4	5	6	7
1 TSK	---	-.14	-.03	.14	<b>.40*</b>	<b>.43**</b>	<b>.43*</b>
2. Strength Training Freq.		---	.21	-.20	-.31	-.31	-.16
3 IRI -PT			---	.05	.01	.08	.22
4 PHODA-M Pain - Time 1				---	<b>.82**</b>	<b>.95**</b>	<b>.78**</b>
5 PHODA-M Pain - Time 2					---	<b>.92**</b>	<b>.95**</b>
6 PHODA-M Harm - Time 1						---	<b>.91**</b>
7 PHODA-M Harm - Time 2							---

**\*\* $p < .01$ , \*  $p < .05$  (TSK = Tampa Scale of Kinesiophobia; PHODA Photograph of Daily Activities Scale-M; IRI-PT Interpersonal Reactivity Index, Perspective Taking subscale)**

## Figures

Figure 1

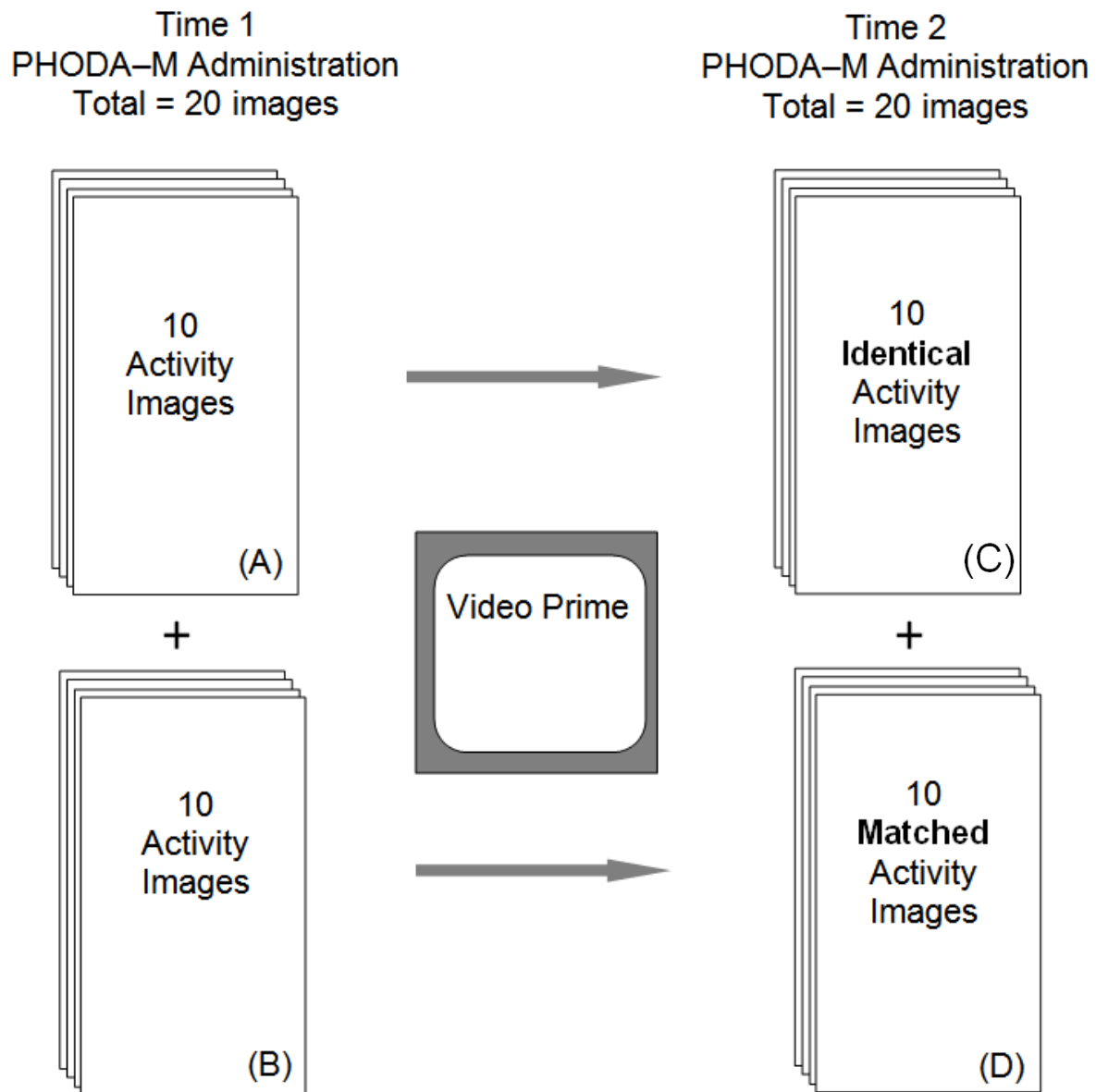


Figure 2

